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(54) **Multilayer films**

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Description

[0001] The present invention relates to multilayer films for naked collation of packs to form packages of 6 or more packs, which can be removed without using cutting tools, as knives, scissors, etc.

[0002] More specifically the present invention relates to multilayer films for naked collation of cigarette packs to form packages of 6-10 or more packs arranged one close to the other having a sealing temperature comprised between 60°C and 80°C, preferably 60°C-78°C, more preferably 70-78°C.

[0003] More specifically the present invention deals with multilayer films for naked collation of cigarette packs to form packages of 6 or more packs arranged one close to the other having the above sealing temperature between the outer layer/outer layer, inner layer/inner layer, inner layer/outer layer and between the outer layer/inner layer of the naked collation film and at the same time without any sealing between the inner layer of the naked multilayer film and the film of the single packs (e.g. cigarette packs).

[0004] It is well known in the art that naked collation has the purpose to wrap and keep together more packs, generally cigarette packs, assembled in groups of 6, 10 or more.

[0005] Wrapping is carried out with a multilayer film that has the advantage of eliminating paper boxes or cardboard boxes used in the prior art. The industrial advantages of the naked collation are clear as they allow to avoid the use of paper or cardboard boxes, that require a separate manufacturing process and at the end the filled cardboard boxes must be wrapped with a film to avoid the damaging of the paper box during the transportation due to rubbing or friction. Therefore the naked collation system allows to eliminate one step in the packaging of cigarette packs. The main feature required to a naked collation film is its sealability. The two film surfaces, the inner and the outer one, must seal as it follows: outer/outer, inner/inner, inner/outer. Further the naked collation film must not seal to the film used for wrapping the single cigarette packs. This feature is required in order to avoid that during the removal of the naked collation film for opening the packaging, the film of the single cigarette packs is not damaged or broken. From the commercial point of view possible breaks or damages of the cigarette pack film brings to the discharge of the single pack as the market does not accept this kind of packs.

[0006] The multilayer film must furthermore possess good mechanical properties, especially in the longitudinal direction (MD) to allow an high collation speed without breaks and maintain the cut length for the naked collation application.

[0007] In fact it is well known that when the naked collation packages of cigarette packs are delivered to the points of sale, the collation film must be removed to expose on the shelf the cigarette packs.

[0008] The need was felt to have available naked collation multilayer films easily removable without using cutting tools, so carrying out the removal under safety conditions.

[0009] Acrylic coating multilayer films for naked collation of cigarette packs are known in general. These films have several drawbacks; their cost is high as the acrylic resin must be sprayed on the multilayer film. Further environmental problems arise for the recycle and the disposal of said acrylic resins. Another disadvantage of these films is the release of white powder, coming from the acrylic resin, on the machine rolls used for packaging. It must be noted that this drawback takes place after few hours during the naked collation process. This brings to a downtime in the process to clean the machines to avoid the powder dispersion into the environment and thus representing a health risk for the workers. In addition it must be avoided that the powder deposits on the single packs as this can create safety and health problems. However the most remarkable drawback of these prior art naked collation films is that they require the use of cutting tools, for example knives or scissors, for their removal. As this operation has caused considerable inconveniences to the users, above all from the safety point of view, the need was felt to have available films for naked collation removable from the cigarette packages without the use of cutting tools.

[0010] US 2010/0224530 A1 discloses a naked collation package comprising an arrangement of individual packages, individually packaged in a polyolefinic filmic material, that are packed together in said naked collation package in a naked collation film, wherein there is no seal between the naked collation film and the filmic material of the individual packages. The examples show that the films of this patent application seal at temperatures higher than 80°C.

[0011] Multilayer films have been surprisingly and unexpectedly found by the Applicant that allow to solve the above technical problem, i.e. the removal of the naked collation film without using mechanical tools, such as knives, scissors, etc. and wherein the sealing temperature between the outer layer/outer layer, inner layer/inner layer, outer layer/inner layer, ranges from 60°C and 80°C, at the same time without sealing between the inner layer of the multilayer film and the film wrapping the single cigarette packs.

[0012] It is besides requested that the naked collation films, commercially available in reels, can be used for producing naked collation packages on manufacturing lines working at a machine speed in the range 70-100 packages/min without sticking of the naked collation film to the machine rolls and to the film wrapping the single packs (for example,the single cigarette packs), therefore with a percentage of waste lower than 1%, preferably lower than 0.1%, more preferably lower than 0.01%.

[0013] It is an object of the present invention multilayer films for naked collation of single packs (for example, cigarette packs) to form packages comprising at least a core layer, an inner layer and an outer layer, wherein:

the outer layer comprises olefin (co)polymers having a melting point in the range 65°C-85°C, preferably 65°C-80°C, still more preferably 70°C-80°C,
the inner layer comprises olefin (co)polymers having a melting point in the range 65°C-105°C, preferably 70°C-90°C, still more preferably 70°C-80°C,
the core layer comprises olefin (co)polymers of propylene and/or butene having melting point equal to or higher than 140°C, preferably from 140°C to 170°C,

wherein the film wrapping the single packs (film (0)) consists of one or more olefin (co)polymers having a melting point higher than 120°C, generally in the range >120°C-170°C, preferably 125°C-165°C, wherein the sealing temperature between the outer layer/outer layer, outer layer/inner layer, inner layer/outer layer of the naked collation multilayer film is in the range 60-80°C, preferably 60-78°C, more preferably 70-78°C and there is no sealing between film (O) and the inner layer of the naked collation multilayer film in the sealing temperature range.

[0014] More specifically, in the multilayer films of the present invention:

the outer layer is formed of olefin (co)polymers and one or more additives,
the inner layer is formed of olefin (co)polymers and one or more additives,
the core layer is formed of olefin (co)polymers of propylene and/or butene and one or more additives,
the film (O) is formed of olefin copolymers and one or more additives and it has a melting point in the range >120°C-170°C,

wherein the one or more additives confer to the layer one or more of the following properties: antistatic, slip, vapour-barrier, antifog, mechanical, flame retardant, optical, antiblock,
wherein in each layer the amount of the one or more additives ranges from 0 to 10% by weight with respect to the layer weight, the layer being constituted of the additive+ one or more (co)polymers,
wherein the sealing temperature is in the range 60-78°C.

[0015] The inner layer of the naked multilayer film of the present invention comes into contact with the film wrapping the single packs.

[0016] The naked multilayer films of the invention are preferably stretched by biaxial simultaneous stretching in the MD machine direction and in the TD transversal direction. To obtain good mechanical properties in MD, the biaxial stretching on flat die filming process is preferably used. The Lisim® technology is preferably used.

[0017] The single packs are preferably cigarette packs arranged one close to the other.

[0018] The olefin (co)polymers of the outer layer and the inner layer are equal to or different from each other. The olefin (co)polymers of the outer layer can be one or more provided that the melting point of the olefin (co)polymers is comprised in the range 65°C-85°C, preferably 70°C-85°C, still more preferably 70°C-80°C.

[0019] The olefin (co)polymers of the inner layer can be one or more provided that the melting point of the one or more (co)polymers is in the range 65°C-90°C, preferably 70°C-90°C, still more preferably 70°C-80°C.

[0020] The olefin (co)polymers that can be used for the inner and outer layer are generally ethylene copolymers comprising one or more alpha-olefin comonomers, linear or branched, having from 3 to 12, preferably from 3 to 8 carbon atoms. Propylene, butene, in particular butene-1, hexene, octene, decene and dodecene can for example be mentioned as monomers. The alpha-olefin total amount is in general comprised from 2% to 50%, preferably from 10% to 40%, more preferably from 15% to 35% by moles. The propylene may range from 0 to 40%, generally from 5% to 30% by moles. The total sum of the comonomers is 100% by moles.

[0021] Other olefin copolymers that can be used are based on propylene, comprising one or more alpha-olefin comonomers, linear or branched, having from 4 to 12, preferably from 4 to 8 carbon atoms, and optionally ethylene. As olefin comonomers, ethylene, butene, preferably butene-1, hexene, octene, decene and dodecene can for example be mentioned. The amount of butene, hexene, octene, decene and dodecene is generally not greater than 2-50%, preferably 10-40%, more preferably 15-35% by moles. The ethylene amount ranges from 0-40%, preferably 3-15%, more preferably 5-10% by moles.

[0022] The total sum of the olefin comonomers being 100% by moles.

[0023] Together with the above indicated monomers, monomers containing more than one ethylenic unsaturation can also be used. It can for example be cited dienes, conjugated or not, linear or branched when possible from 4 to 20 carbon atoms or cyclic wherein the ring has 5 or 6 carbon atoms, preferably vinylcycloalkenes, as for example vinylcyclohexene; aromatic, for example cyclopentadiene; vinylaromatic for example styrene, 2,4 vinylstyrene, optionally one or more hydrogen atoms of the ring being substituted with saturated alkyl groups from 1 to 12 carbon atoms or unsaturated alkyl groups from 2 to 12 carbon atoms, optionally one or more carbon atoms of the ring being substituted by heteroatoms, preferably selected from nitrogen, oxygen, sulphur.

[0024] As monomers containing more than one ethylenic unsaturation, conjugated dienes, for example butadiene, isoprene, piperylene, 1,3-hexadiene, 1,3-octadiene, 2,4-decadiene, cyclopentadiene; non conjugated dienes as 1,4-

hexadiene, 7-methyl-1,6-octadiene cyclic non conjugated dienes as norbornene, ethylidennorbornene, 4-vinylcyclohexene and vinylaromatic monomers as styrene, 2,4-vinylstyrene etc., can be mentioned.

[0025] The amount of dienes is in the range 0-50% by moles, preferably 0.1-25%, more preferably 0.1-10%, even more preferably 0.1-3%.

[0026] Both in the ethylene and propylene-based copolymers other comonomers, such as for example dienic monomers, can be present. Cyclopentadiene and terpenes can in particular be mentioned in amounts up to 10% by moles, preferably from 0 to 5%.

[0027] Typical examples of ethylene-based copolymers are ethylene/propylene; ethylene/propylene/butene; ethylene/butene/ hexene; ethylene/butene/octene, etc.

[0028] Examples of propylene-based copolymers are propylene/ethylene, propylene/ethylene/butene, propylene/butene/ethylene etc.

[0029] The total sum of the comonomers is 100% by moles.

[0030] The polymers of the core layer are preferably selected from propylene and/or butene homopolymers.

[0031] Generally the propylene homopolymers have an extractable amount in hexane preferably lower than 10% by weight, generally lower than 3% by weight.

[0032] The extractable fractions in n-hexane are determined by extraction at 50°C for 2 hours, on the basis of the method according to the FDA 177 - 1520 Standard.

[0033] Preferably among the naked three-layer films of the invention those having as inner layer a compounded masterbatch containing EXACT 0203 and as outer layer a compounded masterbatch containing EXACT 8203 are excluded from the present invention. The film surface can be optionally treated with a discharge treatment, for example corona.

[0034] The films (O) wrapping the single packs are constituted of ethylene-based copolymers or propylene-based copolymers as indicated above for the outer layer or the inner layer of the naked collation film.

[0035] The ethylene-based copolymers contain an amount of alpha-olefin preferably in the range 1-20%, more preferably 3-10% by moles. The propylene-based copolymers contain an amount of alpha-olefin preferably in the range 1-20% by moles. Generally, the amount of alpha-olefin comonomers is in the range 3-5<5 by weight.

[0036] The above olefin (co)polymers are obtained by polymerization with Ziegler Natta catalysts or metallocene catalysts.

[0037] The polymerization for obtaining (co)polymers can be carried out by operating in suspension, in an inert diluent, in emulsion or in a gas phase, the temperatures being generally in the range 0°C-150°C at a pressure generally in the range 1-300 bar, optionally by using a chain transfer agent, for example hydrogen.

[0038] Metallocene polymerization can take place by using catalysts comprising the reaction product between:

1) a bis-cyclopentadienyl derivative of general formula

$$(Cp_1Cp_2)\text{-}M\text{-}(L_2L_3)$$

containing oxygen including groups bound to the transition metal wherein M is a metal selected from group IIIb to group Vb or of the lanthanide series of the periodic table of the elements; Cp_1 and Cp_2, equal to or different from each other, represent the following groups linked to M with delocalized n bonds, in particular with an eta 5 bond when the groups are selected from cyclopentadiene, indene, fluorene or their derivatives substituted in the case of indene and fluorene also with the hydrogenated phenyl ring (rings), and with substituents both in the phenyl and in the cyclopentadienyl rings, also with heteroatoms; or with n bonds as for example in the cyclooctatriene case; otherwise said groups Cp_1 Cp_2 constrained with M through a bivalent linking bridge, for example of the -R- type wherein R is an alkylene preferably from 1 to 4 carbon atoms, $-Si(R')_2-$ type wherein R' is an alkyl from 1 to 10 C atoms, preferably from 1 to 6 carbon atoms; or an aryl optionally containing heteroatoms, such as O, N, or alkylaryl or arylalkyl from 7 to 20 carbon atoms;
L_2 or L_3 equal to or different from each other represent a OR_a group where R_a is an aryl group, optionally the carbon atoms of the ring being substituted also with heteroatoms, and optionally containing substituents for example alkyl from 1 to 10 carbon atonms with

2) a cocatalyst selected from the compounds represented by following formulas:

2a) alumoxane, of general formula:

$$(R_b\text{-Al-O})m,$$

under the form of a cyclic compound or as a linear polymeric compound having formula:

$$R_b(R_b\text{-Al-O})_m\text{Al}\,(R_b,)_2\ ;$$

in general alumoxane is a mixture of the two above indicated forms;

R_b is an alkyl group from 1 to 5 C atoms, preferably selected from methyl,
m is an integer from 1 to 30, preferably from 4 to 20;
m' is an integer from 3 to 20, preferably from 4 to 20;

2b)

$$(L_1\text{-H})^+\ (A)^-$$

wherein $(A)^-$ is a compatible not coordinating anion, it is preferably

$$(B\ Q_q)^-$$

wherein L_1 is a neutral Lewis base,

$(L_1\text{-H})^+$ is a Bronsted acid,
B is an element of the group from IIIa up to VIa of the periodic table of the elements having metalloid characteristics, preferably boron, phosphorus or arsenic in the valence state 3 or 5, silicon, more preferably boron in the valence state 3;
Q, equal to or different from each other, are selected from the following groups: hydrides, halides, alkyls, aryls optionally substituted, for example with halogens, preferably F, alkoxides, aryloxides, dialkylamido, or R_0COO^- wherein R_0 ranges from 1 to 20 carbon atoms, with the proviso that Q can be equal to halide only once;
q is an integer equal to the valence of B plus 1.

[0039] The preferred co-catalyst component 2) is 2b).

[0040] The alumoxane compound 2a) of the catalytic system is preferably prepared by reaction of aluminum triethyl and water, obtaining a mixture of linear and cyclic compounds. In general they are prepared by contacting a solution of aluminum trialkyl with water in suitable organic solvents, for example aliphatic hydrocarbons.

[0041] As known, aluminoxanes are compounds containing Al-O-Al bonds, with a molar ratio in the range O/Al, obtainable in the state of the art by reaction, under controller conditions, of an alkyl aluminum, or alkyl aluminum halide, with water and, in the case of aluminum trimethyl, also with an hydrate salt, as hexahydrate aluminum sulphate, pentahydrate copper sulphate and pentahydrate iron sulphate.

[0042] The molar ratio between Al of the component 2a alumoxane and the amount of the metal of component 1 (metallocene) is in the range 10,000:1 - 100:1, preferably 5,000:1 - 500:1. In the case of the boron compound (2b) the ratio ranges from (0.1-4):1 to preferably (0.5-2.0):1.

[0043] These catalysts are obtained for example by direct reaction of bis-cyclopentadienyl metal dialkyl, preferably dimethyl with the corresponding phenols. The reaction gives substantially quantitative yields. The corresponding phenol can be used in excess as it can also serve as a reaction solvent. Other solvents are for example cyclohexane, methylcyclohexane, hexane, diethylether, benzene, toluene, etc.

[0044] The polymers of the core layer are generally homopolymers. In particular propylene or butene homopolymers, preferably butene-1. The propylene homopolymers are preferred.

[0045] The thickness of the naked film is generally in the range 10-60 μm, preferably 12-40 μm, more preferably 12-30 μm.
The core layer has a thickness of 8-38 μm.
The thickness of the inner layer and of the outer layer equal to or different from each other is in the range 0.3-4 μm, preferably 0.5-1 μm.

[0046] The naked multilayer films of the invention are obtainable by extrusion and subsequent biaxial simultaneous stretching in the MD machine direction and in the TD transversal direction. For obtaining good mechanical properties in particular in MD, the biaxial stretching on flat die is preferably used, preferably by means of the Lisim® machine. This Lisim® technology uses a biaxial simultaneous stretching process, for example as described in USP 4,853,602 and subsequent patents describing this technology.

[0047] The biaxial stretching process comprises the following steps:

- coextrusion of a multilayer plate of the film of the invention having a thickness preferably comprised between about

1 and about 4 mm;

- plate quenching on a chilled roll, at a temperature preferably between 10 and 40°C;
- plate heating at a temperature comprised between about 100° and about 400°C, preferably by infrared rays;
- plate stretching and obtaining the film by taking the edges of the plates, having an higher thickness than the plate, with a series of pliers or clamps independently driven by linear synchronous induction motors, each pliers or clamp sliding on a rail and being pulled by a permanent magnet or by a couple of permanent magnets, pushed by the magnetic wave created by the polar expansions of the linear motor; each section of the stretching frame having a series of linear synchronous induction motors arranged in a contiguous way, fed by alternating currents with phase and frequency modulated so as to vary continuously the clamp (pliers) speed and thus the longitudinal stretching ratios of the film; the transversal stretching ratios being regulated by intervening on the divergence of the rails on which the pliers or clamps slide. The stretching frame comprising one or more sections placed inside an oven having temperatures comprised between about 80°C-210°C, preferably 120°C-190°C; in general the longitudinal stretching ratios being comprised between 3:1 and about 10:1 and the transversal stretching ones between about 3:1 and about 10:1.

[0048] The temperatures in each part of the above mentioned apparatus are selected so as to favour the biaxial orientation of the polymeric chains of the used polymers.

[0049] The longitudinal stretching ratio can be considered equal to the ratio between the speed of the film outletting the stretching frame and the speed of the film inletting the stretching frame.

[0050] The transversal stretching ratio can be considered equal to the ratio between the film width at the outlet of the stretching frame and the film width at the inlet in the stretching frame.

[0051] The possibility given by the simultaneous stretching equipment of varying the MD stretching ratio in a wide range allows to obtain improved mechanical properties in the longitudinal or MD direction. This makes it possible the use of the naked multilayer film in high speed machines for naked collation, for example even with a machine rate of 1,000 single packs/minute corresponding to 100 packages/minute, each package containing 10 packs. As a matter of fact, notwithstanding the high speed, it is possible to maintain the cut length.

[0052] The naked multilayer film of the invention can also be formed of more than three layers provided that the inner layer, the core layer and the outer layer are as defined above. One can have 5 or more layers, for example 7. The additional layers are equal to or different from the previous ones. In the layers additives can be added such as to confer to the naked multilayer film properties known in the art, for example antistatic, slip, vapour-barrier, antifog, mechanical, flame retardant, optical, antiblock.

[0053] The amount of said additives is no more than 10% by w for each layer, wherein the % by w is referred to the sum additives + (co)polymers that constitute the layer. Generally the additives are added in the outer layer and in the inner layer of the film of the present invention. However they can be added also in one or more of the other layers. The additives are those well known in the art.

[0054] As an example slip agents can be selected from higher aliphatic amides, unsaturated fatty acid amides, saturated fatty acid amides such as stearic acid amide, erucic acid amide; higher aliphatic esters; waxes and metal soaps as well as polydimethylsiloxanes; silicon spheres having a diameter from 1 to 4 μm.

[0055] The antistatic agents can be selected from alkali metal alkanesulfonates, polyether-modified, i.e. ethoxylated and/or propoxylated polydiorganosiloxane (polydialkylsiloxanes polyalkylphenylsiloxanes and the like), and/or the essentially straight chain saturated aliphatic

tertiary amines, which have an aliphatic radical having 10 to 20 carbon atoms and are substituted by ω-hydroxy-(C_2-C_4)-alkyl groups, N,N-bis-(2-hydroxyethyl alkylamines having from 10 to 20 carbon atoms, preferably 12 to 18 carbon atoms, in the alkyl radical, are suitable. Furthermore, also glycerol monostearate can be used.

Additives that improve mechanical properties are for example hydrocarbon resins.

Additives with vapour barrier properties are for example hydrocarbon resins.

Additives with antiblock properties are for example inorganic compounds such as SiO_2 $CaCO_3$, magnesium silicate, aluminium silicate, calcium phosphate and the like, and/or incompatible organic polymers such as polyamides, polyesters, polycarbonates and the like, preferably benzoguanamine/formaldehyde polymers, silica and calcium carbonate.

Antifog additives are, for instance, esters of glycerol and fatty acids and/or ethoxylated aliphatic amines.

[0056] The additional layers can be based on olefinic (co)polymers or polymers such as for example EVA (ethyl-vinylacetate polymer), EVOH (ethyl-vinylalcohol polymer), hydrocarbon resins, polyamides, if desired, compatibilizing polymers, etc. can be used.

[0057] The naked multilayer film can also be subjected to the surface treatments known in the art, for example corona, flame treatment, etc. for obtaining improved and more lasting printability and metallizability, while maintaining at the same time the flexibility and mechanical properties.

[0058] The naked multilayer films of the present invention can also be printed, for example by using a primer if requested and subsequent deposition of an ink layer, and then printing by using flexography or rotogravure.

[0059] The naked multilayer film of the present invention used for naked collation of packs (e.g. cigarette packs) to obtain packages is easily removable and allows to avoid the use of cutting tools, so as to safely carry out this operation.

[0060] As said, this was a need felt in the market that the Applicant, after a long research was able to solve surprisingly and unexpectedly.

[0061] As said, the sealing temperature of the multilayer films of the invention is in the range 60°C-80°C, preferably 60°C-78°C, more preferably 70-78°C, determined according to the test reported under in the examples.

[0062] A further object of the present invention is the use of the naked multilayer films of the present invention for naked collation of packs.

[0063] It has been unexpectedly and surprisingly found by the Applicant that by using the naked multilayer film of the invention a very good sealing is obtained at the above indicated low temperatures between the outer layer/outer layer, between the outer layer/inner layer and between the inner layer/inner layer without any sealing between the inner layer of the multilayer film and the film wrapping the single packs.

[0064] This feature was highly desired by the market because it provides the full functionality of the naked collation film.

[0065] It has been found by the Applicant that it is possible to prepare the films of the present invention with the above improved mechanical properties, especially in MD direction, when a biaxial stretching on flat die filming process is used, achievable with Lisim® machine. This technology allows to obtain naked films capable to seal at the indicated temperatures 60°C-80°C, preferably 70-80°C, preferably 60-78°C as shown in the examples and without the sealing to the film wrapping the single packs.

[0066] A further object of the present invention is a process for forming a naked collation package comprising:

- supplying single packs each wrapped with the one or more olefin copolymer films, as defined above,
- supplying a naked collation film of the invention to wrap the single packs arranged one close to the other,
- wrapping the single packs arranged one close to the other in the inner layer of the naked collation film and closing the naked collation film by sealing at temperatures in the range 60°C-80°C, preferably 70°C-80°C, more preferably 60°C-78°C.

[0067] In the naked collation process of the present invention there is no sealing between the inner layer of the multilayer film and the film wrapping the single packs.

[0068] The naked multilayer films of the present invention can be removed from the cigarette packs arranged one close to the other in the package without using cutting tools, by applying a slight twist by hands.

[0069] The Applicant has unexpectedly and surprisingly found that by using the naked collation films of the invention it is possible to operate on the manufacturing line at a machine speed such as to produce 70-100 packages/min without any downtime due to sticking of the films to the machine rolls or to the film wrapping the single packs (i.e. single cigarette packs), giving a percentage of waste lower than 1%, preferably lower than 0.1%, more preferably lower than 0.01%. As waste % it is meant the percentage of discarded packages with respect to the overall amount of produced packages.

[0070] The machine used on the manufacturing lines are typically GD® or FOCKE®.

[0071] The following examples are given for illustrative purposes, but they are not limitative of the invention.

EXAMPLES

ANALYTICAL METHODS

Melting point of the polymers

[0072] The melting point has been determined by DSC.

Determination of the tensile strength, elongation at break and the elastic modulus of the film

[0073] The determinations have been carried out according to the ASTM D882 standard both in the MD and in TD direction by an Instron dynamometer. The elastic modulus has been also determined on the film conditioned at room temperature (20-25°C) for 48 hours after the preparation.

Determination of the mechanical strength of the seal obtained with the film-Test

[0074] Samples having a width of 10 mm are cut out from the film and sealed as described in the examples by using a sealing machine, for example a model "DT Industries SENCORP", with an automatic control of temperature, pressure and contact time of the two sealing bars with the sample to be sealed.

[0075] The sealing conditions are the following:

upper bar heated, lower bar not heated,
contact time between the bars: 0.2 s contact pressure between the bars: 5 psi (34.5 kPa)

[0076] The sealing temperature is varied in the desired temperature range, for example it can be increased from 65°C to 80°C (Table 2) for the sealing outer/inner layer, inner/outer layer and outer/outer layer of the naked collation film.

[0077] The seal mechanical resistance has been measured by an Instron dynamometer.
The test is satisfied when the sealing temperature outer layer/inner layer, inner layer/outer layer outer layer/outer layer is in the range 60-80°C and there is no sealing between the inner layer of the naked collation film and film (O).
The naked collation film complies with the seal mechanical resistance test when the seal mechanical resistance is greater than 50 g/25 mm and at the sealing temperature there is no sealing between the inner layer of the naked collation film and film (O).

EXAMPLE 1

Films for "naked collation"

[0078] A naked film according to the present invention was prepared by a process comprising the following steps:

1) coextrusion of a three layer plate

[0079] Three layers were coextruded on a flat die, each layer having the following composition (% by weight):

core layer:

98% propylene homopolymer HP 522H (Basell) $T_{melting}$ = 163°C,
2% antistatic masterbatch ASPA2446,

outer layer:

95% propylene-alpha-olefin copolymer TAFMER XM7070 (Mitsui) $T_{melting}$ = 75 ° C,
5% antiblock masterbatch ABVT34 SC,

inner layer:

95% TAFMER XM7070,
5% antiblock masterbatch ABVT34 SC.

[0080] The amounts of the polymeric components in each layer are such that in the final film, after the biaxial stretching, the single layers result to have the following thicknesses:

core layer: 23 μm
outer layer: 1 μm
inner layer: 1 μm.

[0081] The profile of the set of temperatures of the three extrusion lines was the following:

core layer: 230°C-265°C
outer layer: 160°C-185°C
inner layer: 160°C-185°C

All the three coextrusion lines were equipped with a filter for removing from the melted polymer any gels or foreign bodies.

[0082] The three lines of the melt were coextruded on a flat die at T= 245°C.

2) Cooling and quenching of the coextruded plate

[0083] The coextruded plate obtained in step 1) was cooled and quenched on a thermostatted roll at T= 28°C, one third of the roll in a water bath at T= 30°C.

3) Trimming of the plate edges and heating in an IR battery

[0084] The plate edges were trimmed up to about 5 cm and then the plate was passed through a battery of IR panels having temperatures in the range: 190°C-270°C.

4) Simultaneous biaxial stretching on a stretching machine

[0085] A LISIM® equipment was used for the biaxial stretching.

[0086] The multilayer film was stretched both in MD longitudinal direction and in TD transversal direction by setting on the machine the following stretching ratios:

MD= 6.20 (ratio between the outlet and inlet speed);
TD= 7.040 (ratio between final and initial TD width):

the outlet speed from the oven being 260 m/min.

[0087] The temperatures of the various sections of the oven were in the ranges reported hereinunder:

Preheating section: 154°C-174°C
Simultaneous stretching section: 158°C-162°C
Stabilization section: 162°C-168°C

5) Wrapping of the naked film in reel

[0088] At the oven outlet the film was passed to the drive section for the following operations:

edge trimming,
X ray scanning for the thickness control.

[0089] At the outlet of the drive section the film was wound on a mother reel having a width of 6,150 mm, thereafter cut into reels of a smaller width.

Film properties

[0090] The mechanical and sealing properties of the naked film have been evaluated.

Mechanical properties

[0091] The obtained results are reported in Table 1 and have been compared with those of a commercial film STILAN® BS25 marketed by BIMO/IRPLAST, having the same total thickness and manufactured with the two step sequential stretching technology, having the same core and a melting temperature of the outer layer 132°C and of the inner layer 140°C.

Table 1

Properties		Example 1	Comparison
Tensile strength (MPa)	MD	1760	1603
	TD	2304	2850
Elongation at break (%)	MD	105	209
	TD	88	63
Elastic modulus (MPa) at t=0 h	MD	1816	1734
	TD	2226	3207
Elastic modulus after ageing for 48h at room temperature (MPa)	MD	2432	2029
	TD	2772	3770

[0092] The Table shows that the naked film of Example 1 of the invention, with respect to the comparative film, shows improved mechanical properties in MD direction. As a matter of fact both the tensile strength and the elastic modulus show an higher value. The Table indicates that the difference between the elastic modulus MD of the naked film of the invention with respect to the comparative film results further increased by repeating the same analyses after 48 hours from the film preparation. It is therefore advisable to use the film of the present invention after ageing for at least one week.

Sealing test

[0093] Both the seal strength of the naked collation film of example 1 sealed on itself, and the seal weld strength of the naked film of the invention sealed with a commercial three layer film STILAN® LTS20 commercialized by BIMO/IR-PLAST, were measured. The film STILAN® LTS20 was used for wrapping the single cigarette packs. The film has a core similar to that of the naked film of example 1, the inner and outer layer are made of polyolefinic copolymers having $T_{melting}$= 132°C. The thickness of the film is equal to that of the naked collation film of example 1.

Seal strength by sealing the outer surface with the inner layer of the naked collation film

[0094] In Table 2 it is reported the seal strength obtained by sealing the outer with the inner layer of the naked film of example 1 at the different temperatures indicated hereunder. As the film is symmetrical, the sealing temperature outer/inner layer is the same as the sealing temperature inner/outer layer and outer/outer layer

TABLE 2

T (°C)	65	70	75	80
Seal strength (g/25 mm)	0	0	67	94

[0095] The data of the table show that the outer layer of the naked film of example 1 seals with the inner layer at the temperature of 75°C already. The value of the seal strength found at this temperature guarantees that the seal is effective for the naked collation of packages of single packs (i.e. cigarette packs), arranged the one close to the other.

Seal strength of the naked film of example 1 sealed with the film wrapping the single packs

[0096] Table 3 reports the seal strength of the inner layer of the film of example 1 sealed with the film used for wrapping the single packs:

Table 3

T (°C)	65	70	75	80	85	90	95	100	105	110	115
Seal strength (g/25 mm)	0	0	0	0	0	0	0	0	0	0	127

[0097] The data of Table 3 show that at the sealing temperature of 75°C, the film wrapping the single packs (i.e. cigarette packs) is not sealed by the naked film of the present invention.

[0098] The results of the sealing tests of Tables 2 and 3 show that the naked collation film according to the present invention can be used for the naked collation of single packs arranged one close to the other. These results further show that the naked collation film in the sealing temperature interval 65-110°C does not seal with the films wrapping the single cigarette packs.

Application with FOCKE® machine

[0099] The naked film of example 1 was tested in an industrial application of "naked collation overwrap" for producing packages each of 10 cigarette packs. The test conditions were the following:

line speed: 700 packs/min, or 70 packages/min.

[0100] The sealing between inner layer/outer layer, outer layer/outer layer, outer layer/inner layer of the film of the invention was obtained at 75°C already and there was no sealing between the inner layer and the film wrapping the single cigarette packs.

[0101] After 1 hour run the production was stopped. it was noticed that no waste was formed.

[0102] During the process it was not necessary to stop the machines for cleaning, as the naked film did not release powders.

[0103] The higher mechanical properties in MD direction allowed a better precision and maintenance of the cut length.

[0104] This is an advantage with respect to the films lacquered with acrylic solution commonly used for the naked collation.

Opening of the naked collated packages

[0105] A multi-pack naked collated package prepared on the FOKE® machine line was opened by twisting it slightly with hands. No adhesion of the naked film of the invention to the film wrapping the cigarette packs (film (0)) was noticed.

Application with GD® machine

[0106] The application example with the FOCKE machine was repeated but using aw GD machine at a line speed of 800 packs/min, or 80 packs/min.

[0107] During the process no downtime for cleaning was made, as the film did not release powders.

[0108] The higher mechanical properties in MD direction allowed a better maintenance of the cut length.

[0109] Also in this case the sealing between the inner layer/outer layer, outer layer/outer layer, outer layer/inner layer of the naked film of the invention was obtained at 75°C already and no sealing was noticed between the inner layer of the naked collation multilayer film and the film wrapping the single cigarette packs.

[0110] After 1 hour run the production was stopped. No waste was formed.

Opening of the naked collated packages

[0111] A naked collated package manufactured with the GD machine was opened by twisting it slightly with hands. No adhesion of the naked film of the invention to the film wrapping the single cigarette packs was noticed.

EXAMPLE 2 (Comparative)

[0112] By using the same process described in example 1 a three layer film was prepared having the following composition:

core layer:

98% propylene homopolymer HP 522H (Basell),
$T_{melting}$= 163°C
2% antistatic masterbatch ASPA2446,

outer layer:

95% propylene-alpha olefin copolymer TAFMER XM7070 (Mitsui) $T_{melting}$= 75°C,
5% antiblock masterbatch ABVT34 SC,

inner layer:

95% polyolefinic copolymer ADSYL 7462 (Basell) $T_{melting}$= 127°C,
5% antiblock masterbatch ABVT34 SC.

Sealing tests

[0113] The sealing tests have been carried out as described in example 1.

[0114] In Table 4 the results obtained by sealing the outer layer/inner layer of the film of comparative ex. 2 are reported.

Table 4

T (°C)	65	70	75	80	85	90	95
Seal strength (g/25 mm)	0	0	0	0	76	83	90

[0115] The data of Table 4 show that the sealing between the outer layer/inner layer of the film of example 2 is obtained starting from a temperature of 85°C.

Application with FOCKE® machine

[0116] The application process using the FOCKE® machine described in example 1 was repeated by using the multilayer film of comparative example 2.

[0117] Line speed: 700 packets/min, or 70 packs/min;
The sealing between the inner layer and outer layer of the film was obtained starting from 85°C.

[0118] It was however noted that at these temperatures the inner layer of the film of the comparative example 2 sticks to the film wrapping the single cigarette packs. The waste was about 10%. The Application was stopped after a short time (6 minutes).

[0119] From an industrial point of view this percentage of scraps makes the film of example 2 not suitable for an industrial application.

Claims

1. Use for naked collation of packs to form packages of 6 or more packs, of multilayer films comprising at least a core layer, an inner layer and an outer layer wherein:

   the outer layer comprises olefin (co)polymers having a melting point in the range 65°C-85°C,
   the inner layer comprises olefin (co)polymers having a melting point in the range 65°C-105°C,
   the core layer comprises olefin (co)polymers of propylene and/or butene having melting point equal to or higher than 140°C,
   wherein the film wrapping the single packs (film (O)) consists of one or more olefin (co)polymers having a melting point higher than 120°C,
   wherein the sealing temperature between the outer layer/outer layer, outer layer/inner layer, inner layer/ outer layer of the naked collation multilayer film is in the range 60-80°C and there is no sealing between film (O) and the inner layer of the naked collation multilayer film in the sealing temperature range,
   wherein
   the melting point is determined by DSC,
   the sealing temperature is determined in the following sealing conditions:

      two sealing bars, upper bar heated, lower bar not heated, contact time between the bars: 0.2 s,
      contact pressure between the bars: 5 psi (34.5 kPa).

2. Use according to claim 1 wherein the multilayer films have been simultaneously biaxially stretched in MD and in TD direction on flat die filming process and then wound in reels.

3. Use according to claims 1-2 wherein the thickness of the inner layer and of the outer layer, equal to or different from each other is in the range 0.5-1 μm.

4. Use according to claims 1-3 wherein the multilayer films are obtainable by a biaxial stretching on flat die filming process comprising the following steps:

   - coextrusion of a multilayer plate of the film of the invention having a thickness preferably comprised between 1 and 4 mm;
   - plate quenching on a chilled roll, at a temperature preferably between 10 and 40°C;
   - plate heating at a temperature comprised between 100° and 400°C, preferably by infrared rays;
   - plate stretching and obtaining the film by taking the edges of the plates, having an higher thickness than the plate, with a series of pliers or clamps independently driven by linear synchronous induction motors, each pliers or clamp sliding on a rail and being pulled by a permanent magnet or by a couple of permanent magnets, pushed by the magnetic wave created by the polar expansions of the linear motor; each section of the stretching frame having a series of linear synchronous induction motors arranged in a contiguous way, fed by alternating currents with phase and frequency modulated so as to vary continuously the clamp (pliers) speed and thus the longitudinal stretching ratios of the film; the transversal stretching ratios being regulated by intervening on the divergence of the rails on which the pliers or clamps slide, the stretching frame comprising one or more sections placed

inside an oven having temperatures comprised between 80°C-210°C; the longitudinal stretching ratios being comprised between 3:1 and 10:1 and the transversal stretching ones between 3:1 and 10:1.

5. Use according to claims 1-4 wherein by operating on a line for manufacturing packages at a machine speed of 70-100 packages/min the percentage of waste is lower than 1%, the waste % defined as the percentage of discarded packages with respect to the overall amount of produced packages.

6. Use according to claims 1-5 wherein in the multilayer films
the outer layer is formed of olefin (co)polymers and one or more additives,
the inner layer is formed of olefin (co)polymers and one or more additives,
the core layer is formed of olefin (co)polymers of propylene and/or butene and one or more additives,
the film (O) is formed of olefin copolymers and one or more additives and has a melting point in the range >120°C-170°C,
wherein the one or more additives confer to the layer one or more of the following properties: antistatic, slip, vapour-barrier, antifog, mechanical, flame retardant, optical, antiblock,
the amount of the one or more additives ranges from 0 to 10% by weight with respect to layer constituted of the additive+ one or more (co) polymers,
wherein the sealing temperature is in the range 60-78°C.

7. Use according to claims 1-6 wherein the single packs are cigarette packs arranged one close to the other.

8. Use according to claims 1-7, wherein the olefin (co) polymers of the outer layer and the inner layer of the multilayer films are equal to or different from each other.

9. Use according to claims 1-8 wherein the outer layer of the multilayer films contains one or more olefin (co) polymers, wherein the melting point of the (co)polymers is in the range 65°C-85°C.

10. Use according to claims 1-9 wherein the inner layer of the multilayer films contains one or more olefin (co)polymers), wherein the melting point of the (co)polymers is in the range 65°C-105°C.

11. Use according to claims 1-10 wherein the (co) polymers of the inner layer and of the outer layer of the multilayer films are selected from ethylene copolymers comprising one or more linear or branched alpha-olefin comonomers having from 3 to 12 carbon atoms or from propylene copolymers, comprising one or more linear or branched alpha-olefin comonomers having from 4 to 12 carbon atoms and optionally ethylene.

12. Use according to claims 1-11 wherein the core layer of the multilayer films consists essentially of propylene and/or butene homopolymers having melting point in the range 140-170°C.

13. Use according to claims 1-12 wherein the thickness of the multilayer film is in the range 10-60 μm, that of the core layer in the range 8-38 μm.

14. Use according to claims 1-13 wherein the multilayer films comprise more than three layers wherein the inner, outer and core layer of the multilayer films are the inner, outer and core layers according to claims 1-13, the added layers being equal to or different from those of the multilayer films of claims 1-13.

15. A process of naked collation packaging comprising:

- supplying single packs, each wrapped in film (O),
- supplying a film for naked collation according to claims 1-14 to wrap the single packs arranged one close to the other,
- wrapping the single packs arranged one close to the other in the inner layer of the naked collation multilayer film according to claims 1-14 and closing the naked collation multilayer film by sealing at temperatures in the range 60°C-80°C.

16. Packages obtainable by naked collation of packs by using the naked collation multilayer films according to claims 1-14.

Patentansprüche

1. Verwendung für Naked-Collage-Paketen, um Packungen aus 6 oder mehr Paketen zu bilden, von mehrschichtigen Folien, umfassend mindestens eine Kernschicht, eine Innenschicht und eine Außenschicht, wobei die Außenschicht Olefin-(Co)Polymere umfasst, aufweisend einen Schmelzpunkt im Bereich von 65 °C bis 85 °C, wobei die Innenschicht Olefin-(Co)Polymere umfasst, aufweisend einen Schmelzpunkt im Bereich von 65 °C bis 105 °C, wobei die Kernschicht Olefin-(Co)Polymere aus Propylen und/oder Buten umfasst, aufweisend einen Schmelzpunkt, der größer oder gleich 140 °C ist, wobei die Folie, mit der die einzelnen Pakete umwickelt sind (Folie (0)) aus einem oder mehreren Olefin-(Co)Polymeren besteht, aufweisend einen Schmelzpunkt, der höher ist als 120 °C, wobei die Siegeltemperatur zwischen Außenschicht/Außenschicht, Außenschicht/Innenschicht, Innenschicht/Außenschicht der mehrschichtigen Naked-Collation-Folie im Bereich von 60 °C bis 80 °C liegt und keine Siegelung zwischen Folie (0) und der Innenschicht der mehrschichtigen Naked-Collation-Folie im Siegeltemperaturbereich stattfindet, wobei der Schmelzpunkt über PLS ermittelt wird und die Siegeltemperatur unter den folgenden Siegelbedingungen ermittelt wird: zwei Siegelstäbe, oberer Siegelstab erhitzt, unterer Siegelstab nicht erhitzt, Kontaktzeit zwischen den Siegelstäben 0,2 s, Kontaktdruck zwischen den Siegelstäben 5 psi (34,5 kPa).

2. Verwendung nach Anspruch 1, wobei die mehrschichtigen Folien gleichzeitig biaxial in MD- und TD-Richtung bei einem Flachmatritzenfolienherstellungsprozess gestreckt und dann in Spulen gewunden werden.

3. Verwendung nach Anspruch 1 bis 2, wobei die Dicke der Innenschicht und der Außenschicht, gleich oder unterschiedlich voneinander, im Bereich von 0,5 bis 1 μm liegt.

4. Verwendung nach Anspruch 1 bis 3, wobei die mehrschichtigen Folien durch biaxiales Strecken bei einem Flachmatritzenherstellungsprozess erhalten werden können, umfassend die folgenden Schritte:

   - Koextrusion einer mehrschichtigen Platte der erfindungsgemäßen Folie, aufweisend eine Dicke, die vorzugsweise zwischen 1 und 4 mm beträgt;
   - Abschrecken der Platte auf einer gekühlten Walze bei einer Temperatur, die vorzugsweise zwischen 10 und 40 °C beträgt;
   - Erhitzen der Platte bei einer Temperatur zwischen 100 °C und 400 °C, vorzugsweise durch Infrarotstrahlen;
   - Strecken der Platte und Erhalten der Folie, indem die Ränder der Platten, die eine höhere Dicke als die Platte aufweisen, mit einer Reihe von Zangen oder Klammern gegriffen werden, die separat über lineare Synchron-Induktionsmotoren angetrieben werden, wobei jede Zange oder Klammer auf einer Schiene verfährt und von einem Permanentmagneten oder einem Paar Permanentmagneten gezogen wird, vorgeschoben durch die Magnetwelle, die durch die polaren Expansionen des Linearmotors erzeugt wird, wobei ein jeder Abschnitt des Streckrahmens eine Reihe linearer Synchron-Induktionsmotoren aufweist, die angrenzend angeordnet sind und über Wechselströme mit Phasen- und Frequenzmodulation gespeist werden, sodass die Geschwindigkeit der Klammer (Zange) und somit die Längsstreckungsverhältnisse der Folie kontinuierlich geändert werden, wobei die Querstreckungsverhältnisse durch Ändern der Spurweite der Schienen, auf denen die Zangen oder Klammern verfahren, reguliert wird, wobei der Streckrahmen einen oder mehrere Abschnitte umfasst, die in einem Ofen platziert sind und Temperaturen zwischen 80 °C und 210 °C aufweisen, wobei die Längsstreckungsverhältnisse zwischen 3:1 und 10:1 und die Querstreckungsverhältnisse zwischen 3:1 und 10:1 umfasst sind.

5. Verwendung nach Anspruch 1 bis 4, wobei der Abfallanteil beim Arbeiten an einer Anlage zur Herstellung von Packungen bei einer Maschinengeschwindigkeit von 70 bis 100 Packungen pro Minute niedriger ist als 1 %, wobei der Abfallprozentanteil als Anteil an ausgesonderten Packungen an der Gesamtzahl der hergestellten Packungen definiert ist.

6. Verwendung nach Anspruch 1 bis 5, wobei die Außenschicht bei den mehrschichtigen Folien aus Olefin-(Co)Polymeren und einem oder mehreren Zusatzstoffen gebildet ist, die Innenschicht aus Olefin-(Co)Polymeren und einem oder mehreren Zusatzstoffen gebildet ist, die Kernschicht aus Olefin-(Co)Polymeren aus Propylen und/oder Buten und einem oder mehreren Zusatzstoffen gebildet ist, die Folie (O) aus Olefin-Copolymeren und einem oder mehreren Zusatzstoffen gebildet ist und einen Schmelzpunkt im Bereich von >120 °C bis 170 °C aufweist, wobei der eine oder die mehreren Zusatzstoffe der Schicht eine oder mehrere der folgenden Eigenschaften verleihen: antistatisch, Schlupf, Dampfsperre, Nebelschutz, Festigkeit, flammhemmend, Optik, Blockierungsschutz, wobei die Menge des einen oder der mehreren Zusatzstoffe im Bereich von 0 bis 10 % Gewichtsanteil gegenüber der aus Zusatzstoff + einem oder mehreren (Co)Polymeren bestehenden Schicht liegt, wobei die Siegeltemperatur im Bereich von 60 °C bis 78 °C liegt.

7. Verwendung nach Anspruch 1 bis 6, wobei es sich bei den einzelnen Packungen um Zigarettenpackungen handelt, die aneinander angeordnet sind.

8. Verwendung nach Anspruch 1 bis 7, wobei die Olefin-(Co)Polymere der Außenschicht und der Innenschicht der mehrschichtigen Folien gleich sind oder sich voneinander unterscheiden.

9. Verwendung nach Anspruch 1 bis 8, wobei die Außenschicht der mehrschichtigen Folien ein oder mehrere Olefin-(Co)Polymere enthält, wobei der Schmelzpunkt der (Co)Polymere im Bereich von 65 °C bis 85 °C liegt.

10. Verwendung nach Anspruch 1 bis 9, wobei die Innenschicht der mehrschichtigen Folien ein oder mehrere Olefin-(Co)Polymere enthält, wobei der Schmelzpunkt der (Co)Polymere im Bereich von 65 °C bis 105 °C liegt.

11. Verwendung nach Anspruch 1 bis 10, wobei die (Co)Polymere der Innenschicht und der Außenschicht der mehrschichtigen Folien ausgewählt sind aus EthylenCopolymeren, umfassend ein oder mehrere lineare oder verzweigte Alpha-Olefin-Comonomere, aufweisend 3 bis 12 Kohlenstoffatome, oder aus Propylencopolymeren, umfassend ein oder mehrere lineare oder verzweigte Alpha-Olefin-Comonomere, aufweisend 4 bis 12 Kohlenstoffatome, und optional aus Ethylen.

12. Verwendung nach Anspruch 1 bis 11, wobei die Kernschicht der mehrschichtigen Folien im Wesentlichen aus Propylen- und/oder Butenhomopolymeren besteht, aufweisend einen Schmelzpunkt im Bereich von 140 °C bis 170 °C.

13. Verwendung nach Anspruch 1 bis 12, wobei die Dicke der mehrschichtigen Folie im Bereich von 10 bis 60 μm liegt, die der Kernschicht im Bereich von 8 bis 38 μm.

14. Verwendung nach Anspruch 1 bis 13, wobei die mehrschichtigen Folien mehr als drei Schichten umfassen, wobei die Innen-, die Außen- und die Kernschicht der mehrschichtigen Folien die Innen-, die Außen- und die Kernschicht nach Anspruch 1 bis 13 sind und die hinzugefügten Schichten denen der mehrschichtigen Folien nach Anspruch 1 bis 13 gleichen oder sich von diesen unterscheiden.

15. Naked-Collation-Verpackungsverfahren, umfassend:

- Zuführen einzelner Pakete, die jeweils in Folie (O) eingewickelt sind;
- Zuführen einer Naked-Collation-Folie nach Anspruch 1 bis 14, um die einzelnen Pakete, die aneinander angeordnet sind, einzuwickeln;
- Einwickeln der einzelnen, aneinander angeordneten Pakete in die Innenschicht der mehrschichtigen Naked-Collation-Folie nach Anspruch 1 bis 14 und Verschließen der mehrschichtigen Naked-Collation-Folie durch Siegeln bei Temperaturen im Bereich von 60 °C bis 80 °C.

16. Packungen, die durch Naked Collation von Paketen erhalten werden können, indem mehrschichtige Naked-Collation-Folien nach Anspruch 1 bis 14 verwendet werden.

Revendications

1. Utilisation destinée à un assemblage à nu de paquets pour former des emballages de 6 ou davantage de paquets, de films multicouches comprenant au moins une couche centrale, une couche interne et une couche externe dans laquelle : la couche externe comprend des (co)polymères d'oléfine ayant un point de fusion situé entre 65 et 85 °C, la couche interne comprend des (co)polymères d'oléfines ayant un point de fusion situé entre 65 et 105 °C, la couche centrale comprend des (co)polymères d'oléfine de propylène et/ou de butène ayant un point de fusion égal ou supérieur à 140 °C, dans laquelle le film enveloppant les paquets individuels (film (0)) consiste en un ou plusieurs (co)polymères d'oléfine ayant un point de fusion supérieur à 120 °C, dans laquelle la température de scellement entre la couche externe/couche externe, la couche externe/la couche interne, la couche interne/la couche externe du film multicouche de l'assemblage à nu se situe entre 60 et 80 °C et il n'y a pas de scellement entre le film (0) et la couche interne du film multicouche de l'assemblage à nu dans la fourchette de température de scellement, dans laquelle le point de fusion est déterminé par calorimètre à compensation de puissance, la température de scellement est déterminée dans les conditions de scellement suivantes : deux barres de scellement, barre supérieure chauffée, barre inférieure non chauffée, temps de contact entre les barres : 0,2 s, pression de contact entre les barres : 5 psi

(34,5 kPa).

2. Utilisation selon la revendication 1, dans laquelle les films multicouches ont été simultanément étirés biaxialement dans le sens machine et dans la direction transversale sur un procédé à filmer de filière plate puis enroulés sur des bobines.

3. Utilisation selon les revendications 1 et 2, dans laquelle l'épaisseur de la couche interne et de la couche externe, égale entre elles ou différente l'une de l'autre est comprise entre 0,5 et 1 μm.

4. Utilisation selon les revendications de 1 à 3, dans laquelle les films multicouches peuvent être obtenus par un étirement sur un procédé à filmer de filière plate comprenant les étapes suivantes :

- coextrusion d'une plaque multicouche du film objet de l'invention ayant une épaisseur de préférence comprise entre 1 et 4 mm ;
- refroidissement rapide de la plaque sur un rouleau froid, à une température comprise de préférence entre 10 et 40 °C ;
- chauffage de la plaque à une température comprise entre 100 et 400 °C, de préférence par rayon infrarouge ;
- étirement de la plaque et obtention du film en prenant les bords des plaques, ayant une épaisseur supérieure à la plaque, par un ensemble de pinces ou mâchoires entraînées de façon indépendante par des moteurs linéaires synchrones à induction, chaque pince ou mâchoire coulissant sur un rail et étant tirée par un aimant permanent ou par un couple d'aimants permanents poussés par l'onde magnétique créée par les extensions polaires du moteur linéaire ; chaque section du châssis d'étirement ayant un ensemble de moteurs linéaires synchrones à induction, disposés de façon contiguë, alimentés par des courants alternatifs avec une phase et une fréquence modulées de manière à varier continuellement la vitesse de la mâchoire (pinces) et donc les rapports d'étirement longitudinal du film ; les rapports d'étirement transversal étant réglés en intervenant sur l'écart des rails sur lesquels coulissent les pinces ou mâchoires, le châssis d'étirement comprenant une ou plusieurs sections placées à l'intérieur d'un four porté à des températures comprises entre 80 et 210 °C ; les rapports d'étirement longitudinal et transversal étant tous deux compris entre 3:1 et 10:1.

5. Utilisation selon les revendications de 1 à 4, dans laquelle en opérant sur une ligne de fabrication d'emballages à une cadence de 70-100 emballages/min, le pourcentage de perte est inférieur à 1 %, le pourcentage de perte étant défini par le pourcentage d'emballages mis au rebut par rapport à la quantité globale d'emballages produits.

6. Utilisation selon les revendications de 1 à 5, dans laquelle dans les films multicouches, la couche extérieure est formée de (co)polymères d'oléfine et d'un ou plusieurs additifs, la couche interne est formée de (co)polymères d'oléfine et d'un ou plusieurs additifs, la couche centrale est formée de (co)polymères d'oléfine de propylène et/ou de butène et d'un ou plusieurs additifs, le film (0) est formé de copolymères d'oléfine et d'un ou plusieurs additifs et possède un point de fusion étant > à 120 °C et <= à 170 °C, dans laquelle l'un ou plusieurs additifs confèrent à la couche une ou plusieurs des propriétés suivantes : antistatique, glissante, pare-vapeur, antibuée, mécanique, ignifuge, visuelle, anti-blocage, la quantité de l'un ou plusieurs additifs étant comprise entre 0 et 10 % en poids par rapport à la couche constituée de l'additif plus un ou plusieurs (co)polymères, dans laquelle la température de scellement est comprise entre 60 et 78 °C.

7. Utilisation selon les revendications de 1 à 6, dans laquelle les paquets individuels sont des paquets de cigarettes disposés les uns à côté des autres.

8. Utilisation selon les revendications de 1 à 7, dans laquelle les (co)polymères d'oléfine de la couche externe et de la couche interne des films multicouches sont égaux entre eux ou différents les uns des autres.

9. Utilisation selon les revendications de 1 à 8, dans laquelle la couche externe des films multicouches contient un ou plusieurs (co)polymères d'oléfine, dans laquelle le point de fusion des (co)polymères se situe entre 65 et 85 °C.

10. Utilisation selon les revendications de 1 à 9, dans laquelle la couche interne des films multicouches contient un ou plusieurs (co)polymères d'oléfine, dans laquelle le point de fusion des (co)polymères se situe entre 65 et 105 °C.

11. Utilisation selon les revendications de 1 à 10, dans laquelle les (co)polymères de la couche interne et ceux de la couche externe des films multicouches sont sélectionnés à partir de copolymères éthyliques comprenant un ou plusieurs comonomères d'alpha-oléfine linéaires ou ramifiés ayant de 3 à 12 atomes de carbone ou à partir de

copolymères de propylène comprenant un ou plusieurs comonomères d'alpha-oléfine linéaires ou ramifiés ayant de 4 à 12 atomes de carbone et éventuellement d'éthylène.

12. Utilisation selon les revendications de 1 à 11, dans laquelle la couche centrale des films multicouches consiste essentiellement en des homopolymères de propylène et/ou de butène ayant un point de fusion situé entre 140 et 170 °C.

13. Utilisation selon les revendications de 1 à 12, dans laquelle l'épaisseur du film multicouche est comprise entre 10 et 60 μm et celle de la couche centrale entre 8 et 38 μm.

14. Utilisation selon les revendications de 1 à 13, dans laquelle les films multicouches comprennent plus de trois couches dans laquelle les couches interne, externe et centrale des films multicouches sont les couches interne, externe et centrale selon les revendications de 1 à 13, les couches ajoutées étant équivalentes à ou différentes de celles des films multicouches des revendications de 1 à 13.

15. Processus d'emballage assemblé à nu comprenant :

- la fourniture de paquets individuels, chacun étant enveloppé dans un film (0),
- la fourniture d'un film pour l'assemblage à nu selon les revendications de 1 à 14 pour envelopper les paquets individuels disposés les uns à côté des autres,
- l'enveloppement des paquets individuels disposés les uns à côté des autres dans la couche interne du film multicouche d'assemblage à nu selon les revendications de 1 à 14 et la fermeture du film multicouche d'assemblage à nu par scellement à des températures comprises entre 60 et 80 °C.

16. Emballages pouvant être obtenus par l'assemblage à nu de paquets en utilisant des films multicouches d'assemblage à nu selon les revendications de 1 à 14.

REFERENCES CITED IN THE DESCRIPTION

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